

Distributed Information Services: Climate/Ocean Products and Visualization for Earth Research (DISCOVER): A NASA funded project producing and distributing research and climate quality ocean microwave sea surface temperatures, surface wind speeds, water vapor, cloud liquid water and rain rates. Producing valuable Earth Science Data Records (ESDR) involves more than just designing and delivering a dataset to a storage facility. In addition to creating serveral climate quality microwave data products, our experience has taught us that additional tasks are necessary to making a successful, highly valued data set. Here we list important tasks that we have found are necessary to increasing the use of a data set and improving the quality of the data set over time. The DATA USERS are the main focus of these tasks.

Consistency

We begin with instrument counts, reverse engineering back to counts when necessary. Then we process forward with as consistant a methodology across different sensors and platforms as possible. The table the right lists some key steps involved. This insistence on consistency is how we produce long-term climate quality data sets for a variety of different instruments on different satellites. Figure 1 at right shows the excellent agreement we obtain between all SSM/I water vapor and wind speeds for 1987 to 2006.

Essential Steps for the Creation of Inter-Calibrated, Multi-Instrument Data Records

- ❖ Start with original instrument counts
- ❖ Apply consistent quality control procedures
- ❖ Adjust geolocation / satellite attitude problems
- ❖ Correct for any along-scan biases
- ❖ Correct any hot load or antenna emissivity problems
- ❖ Intercalibrate instruments at brightness temperature level
- ❖ Apply a uniform algorithm to obtain geophysical retrievals
- ❖ Correct for sun glitter or radio frequency interference
- ❖ Test for product consistency over time and instruments
- ❖ Validate with other data sources, "truth"
- ❖ Merge geophysical data accounting for diurnal variability

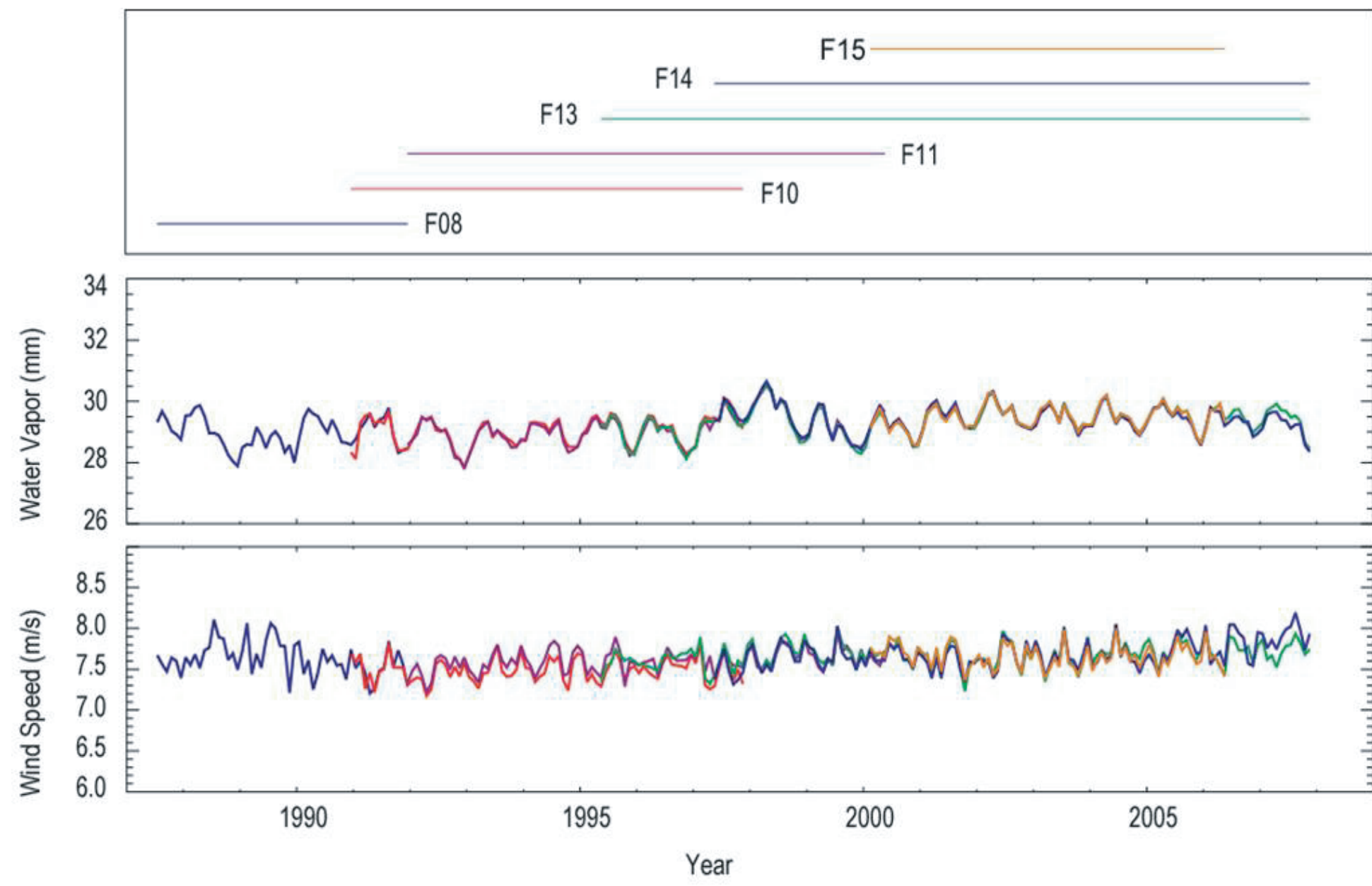


Figure 1. Wind Speed and Water Vapor global values for six SSM/I instruments flown successively on DMSP platforms. The agreement between data from different instruments is due to the careful intercalibration and consistent data processing performed by the DISCOVER scientists.

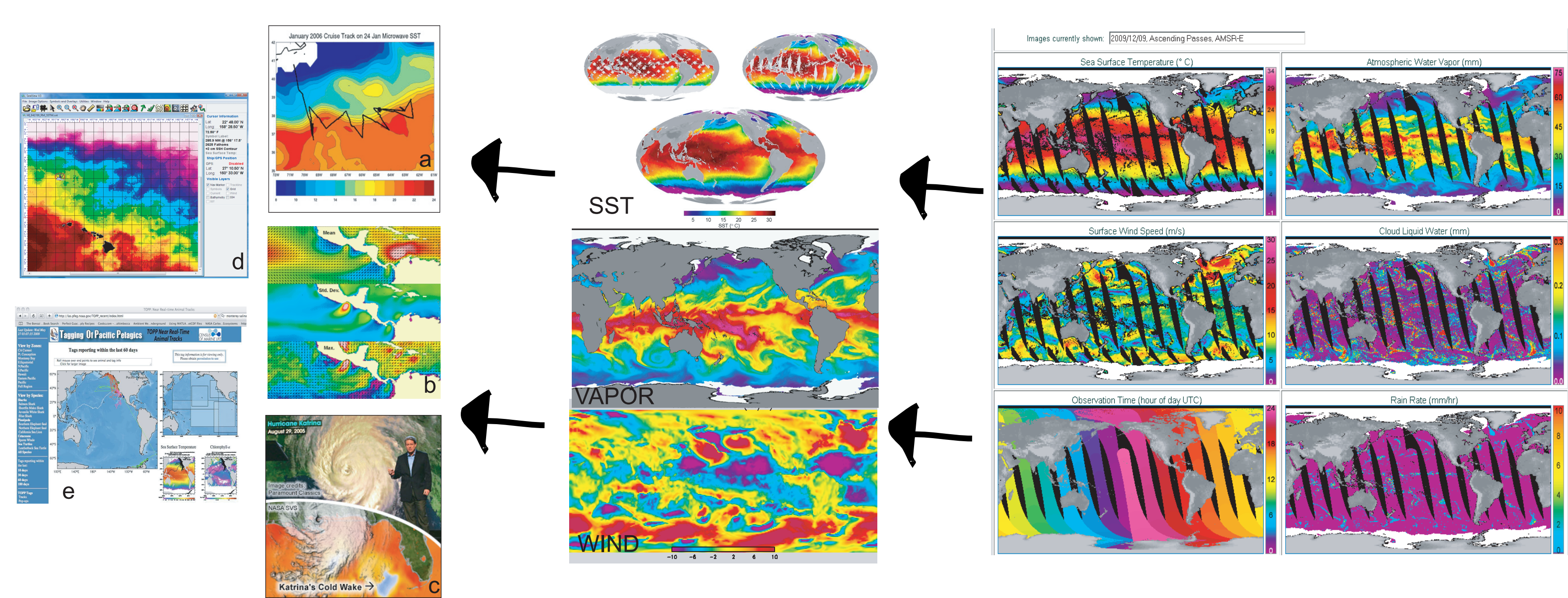


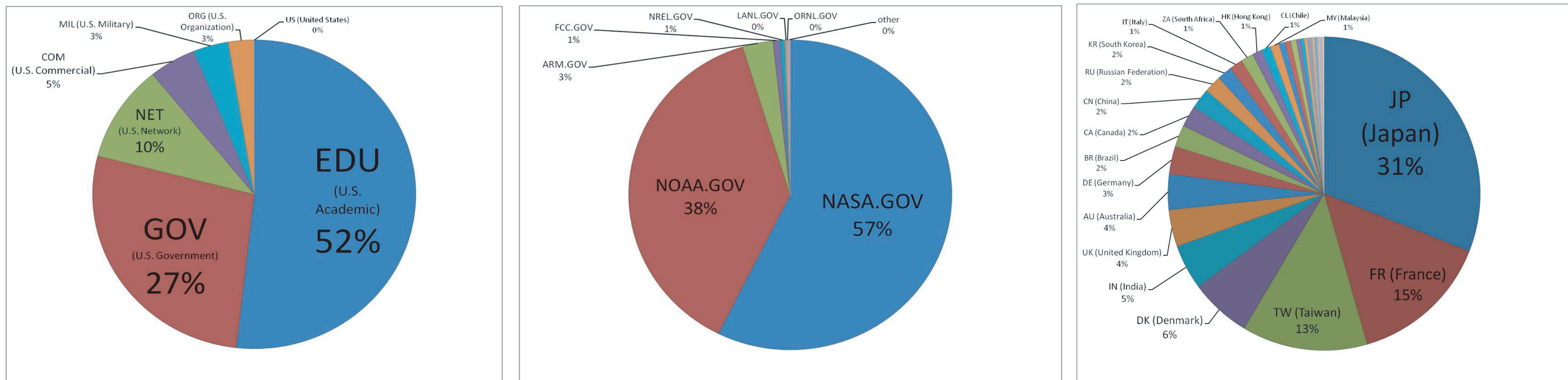
Figure 7. Passive microwave satellite products (far right) and merged products (center) are distributed to other scientists and make their way into important value-added products (left columns). The value added products shown here include a) SST maps for guiding CLIMODE field research, b) Royal Australian Navy GIS interface for use in strategic, operational and tactical planning, SSTs used in *An Inconvenient Truth* and Al Gore presentations, d) SST in a commercial fisheries interface produced and distributed by Ocean Imaging, e) SSTs in a Pacific Pelagic near real-time tracking web site.Type

Help Others Add Value

Producing a data set is only one step in providing data. We find that our microwave data are being used in many types of research, some of which include the production of more publicly released data sets. We have a closer relationship with our Value-Added Data Redistributors that allows us to notify them of data problems or prioritize data delivery. Examples of these types of users are shown here and include wind, sea surface temperature, cloud and water vapor products. Our high quality, carefully intercalibrated microwave data are an important part of these products.

Know Your Users

We have distributed our microwave data sets via web and ftp servers since 1997. User statistics have been collected to help us understand who our data users are. Figures 2-4 below show a breakdown of our international and domestic users for the past 5 years. This type of information assists us in determining what meetings to attend and where to direct information about our data.



Figures 2-4. Breakdown of DISCOVER data users from 2004 to 2009. These pie charts show our users to be primarily from educational and government institutions, mostly from NASA and NOAA, with a majority of international users from Japan, Taiwan and France.

Validate and Document

Validation of our data is imperative. Each year we perform comparisons of our passive microwave data products with those from buoys, models and ships. These results are provided on our web site and in technical documents. This annual validation allows us to locate any problems. Figure 5 below shows the daily monitoring of the sea surface temperature quality.

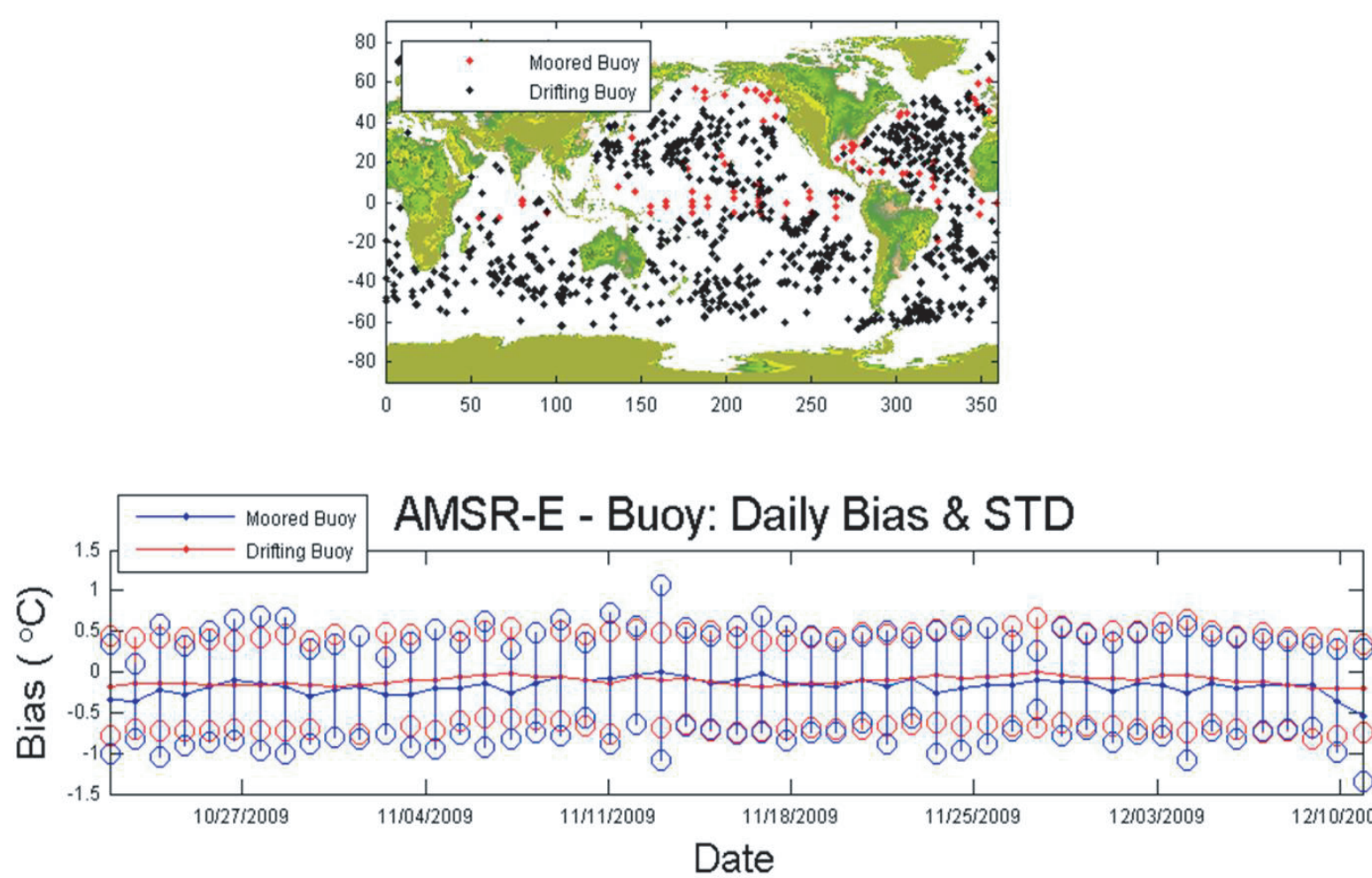


Figure 5. Example of our real-time SST validation web page. These plots show the mean and standard deviation of AMSR-E minus buoy SSTs. This information is monitored daily by DISCOVER staff.

Be a User

Scientific research completed at Remote Sensing Systems uses the public data set that we distribute. We believe it is important to be one of the data users so that we have first-hand experience with the characteristics of our data. Some important science has come from this work, including the 2007 paper in Science journal noting the sizable difference in 20-yr rain rate trends from climate models and SSM/I data. Figure 6 shows this comparison.

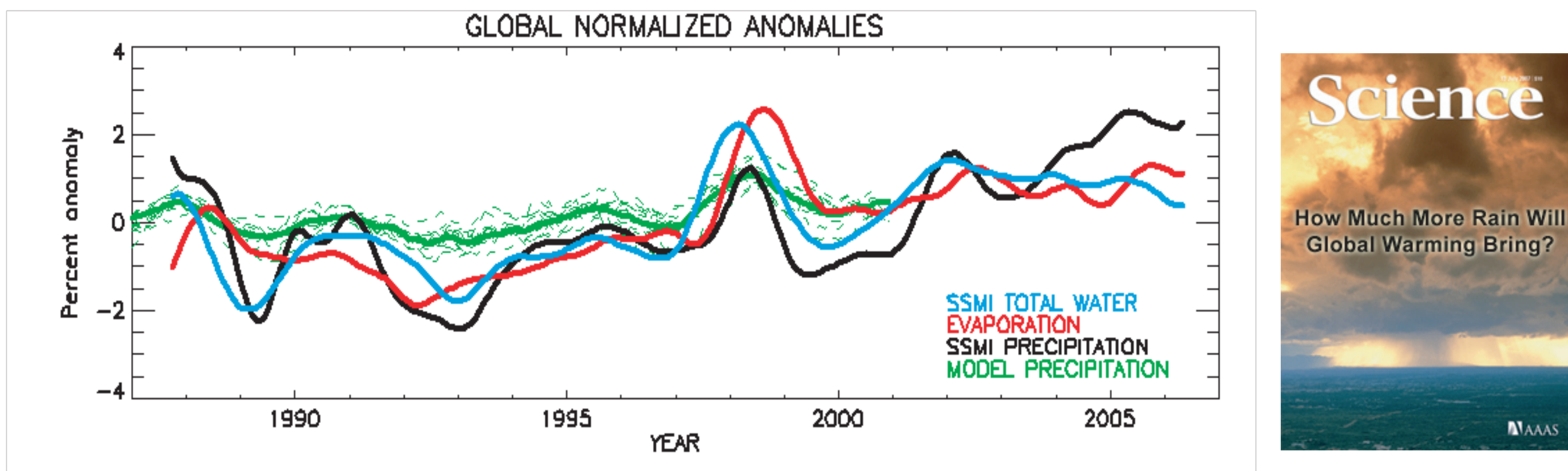


Figure 6 Global trends in total water, evaporation, precipitation calculated from SSM/I passive microwave data compared with those from models (green). The total water (1.2%/decade), evaporation (1.3%/decade) and precipitation (1.4%/decade) are similar and a much lower trend (0.4%/decade) found with AMIP models. These SSM/I results were published in Science (Wentz et al, 2007).

Listen and Respond

Users contact our support box for many reasons (see below). We take each question seriously, answer quickly, and connect the data user to the scientist responsible for the data they are using. Much time is spent making sure that we understand the problem or question and can explain the solution or answer to the data user. This often involves trying to reproduce the results of our users, which helps us hone in on the crucial information they may need to properly use and interpret our data. By knowing the types of questions data users ask, we can better understand what changes to make to our data in the future.

Type of User Question	Percent
question about the data	24.6
data for a particular date/time/loc	9.7
ftp problems	9.7
code request or problem	9.0
documentation request	9.0
missing data	6.0
validation/accuracy info	3.7
request for real time support	3.7
problem with the data	3.0
instrument information	3.0
Question re data found elsewhere	2.2
No data over land?	2.2
kudos	2.2
notice of publication using data	2.2
contact info/acknowledgement info	2.2
file format GIS import	1.5
web page problem	0.7
request for data we don't have	0.7
other unrelated questions	4.5
Total	100.0

Monitor Contributions

We monitor publications in major scientific journals to locate papers that report research results that include the use of DISCOVER data. This type of information is useful for identifying how our data are being used and what important scientific questions are being answered using our data products. This type of information is reported to NASA so that they can understand the scientific value of DISCOVER data. Here we show just a small portion of the journals containing publications in which DISCOVER data have been used. Since Jan 1, 2000, we've identified over 400 publications in over 40 journals that use DISCOVER data in the reported research. This table lists the 15 journals with the most publications per journal.

Top 15 Journals Citing Use of DISCOVER Data (2000-2009)	
Journal of Geophysical Research	81
Journal of Climate	75
Geophysical Research Letters	63
Journal of Atmospheric and Oceanic Tech.	20
IEEE Trans. Geoscience and Remote Sensing	17
Monthly Weather Review	14
Journal of Physical Oceanography	13
International Journal of Remote Sensing	11
Journal of Applied Met. and Climatology	11
Journal of the Atmospheric Sciences	8
Science	7
BAMS	6
Journal of Oceanography	5
Quarterly J. Royal Meteorological Society	3
Remote Sensing of Environment	3

Focus on Data Over Time

We not only inspect and validate our data each year independently, but look at the quality of the data over time to check for spurious trends or other possible data quality problems. We do the same with our user statistics in order to determine if our data products continue to be valued by the user community. The plot at right shows DISCOVER data usage continues to increase over the past 5 years.

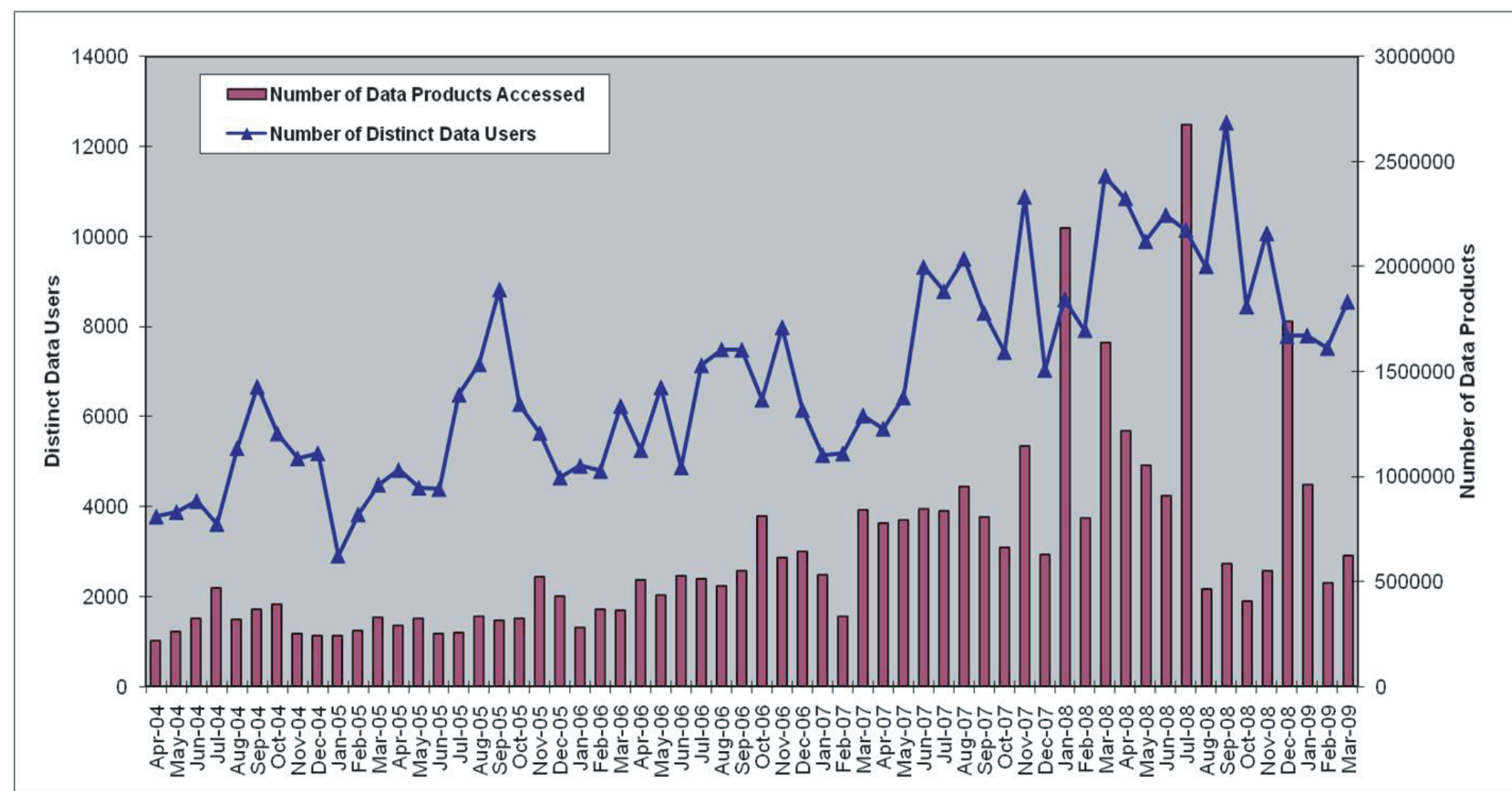


Figure 8. Graph showing the increase in data file download and unique data users over 5 years from 2004 to 2009.